UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/710,250	06/29/2004	Qin Jiang	DP-300915	4249

22851 7590 12/30/2008

DELPHI TECHNOLOGIES, INC.
M/C 480-410-202
PO BOX 5052
TROY, MI 48007

EXAMINER	
DAM, DUSTIN Q	
ART UNIT	**PAPER NUMBER**
1795	

MAIL DATE	DELIVERY MODE
12/30/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/710,250	JIANG ET AL.	
	Examiner	Art Unit	
	DUSTIN Q. DAM	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 September 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *6/29/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 2, 2008 has been entered.

2. Claims 1-19 are currently pending and have been fully considered.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-3, 5, 7-13, and 16-19 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by WISE et al. (U.S. Patent 5,100,479).

a. With regards to claim 1, WISE et al. discloses a stacked thermocouple structure comprising a plurality of first conductors (34, FIG. 3) on a surface (40, FIG. 3) and formed of a first material (line 51, column 5 "polysilicon"), each of the first conductors having first (end closest to aperture 22, FIG. 2A-B and FIG. 3) and second ends (end farthest from aperture 22, FIG. 2A-B and FIG. 3) and a thickness in a direction normal to

the surface (T1, blown-up version-1 of FIG. 3 presented below), a dielectric layer on each of the first conductors (38, FIG. 3), a plurality of second conductors (36, FIG. 2B and FIG. 3) on the dielectric layer (FIG. 3) and formed of a second material that differs from the first material (line 23-26, column 7 "refractory metal"), each of the second conductors having a thickness in a direction normal to the surface (T2, blown-up version-1 of FIG. 3 presented below), a first end (end closest to aperture 22, FIG. 2A-B and FIG. 3) overlying the first end of the corresponding first conductor in a direction normal to the surface and contacting the first end of the corresponding first conductor (via hole 52, FIG. 2A-B and FIG. 3), and a second end (end farthest from aperture 22, FIG. 2A-B and FIG. 3) overlying the second end of the corresponding first conductor in a direction normal to the surface but separated from the second end of the corresponding first conductor by the dielectric layer, and a plurality of third conductors ("L-shaped" portion of 36, FIG. 2B which extends off of each first conductor leading to the next adjacent first conductor), each of the third conductors electrically interconnecting the second end of one of the second conductors with the second end of one of the first conductors other than the first conductor on which the second conductor lies (FIG. 2B), each of the third conductors having a thickness in a direction normal to the surface (T3, blown-up version-1 of FIG. 3 presented below) that is greater than the thickness of the second conductors (T3, or a thickness of the third conductor portion of 36, traverses over first conductor layer 34 and dielectric layer 38 of which line 2, column 7 discloses T1 to be 8000Å and line 11-16, column 7 discloses Td is 3000Å, thus making T3 at least 11000Å plus some

thickness above layer 38, T2 is 3000Å plus some thickness above layer 38, thus T3 is at least thicker than T2 by 8000 Å).

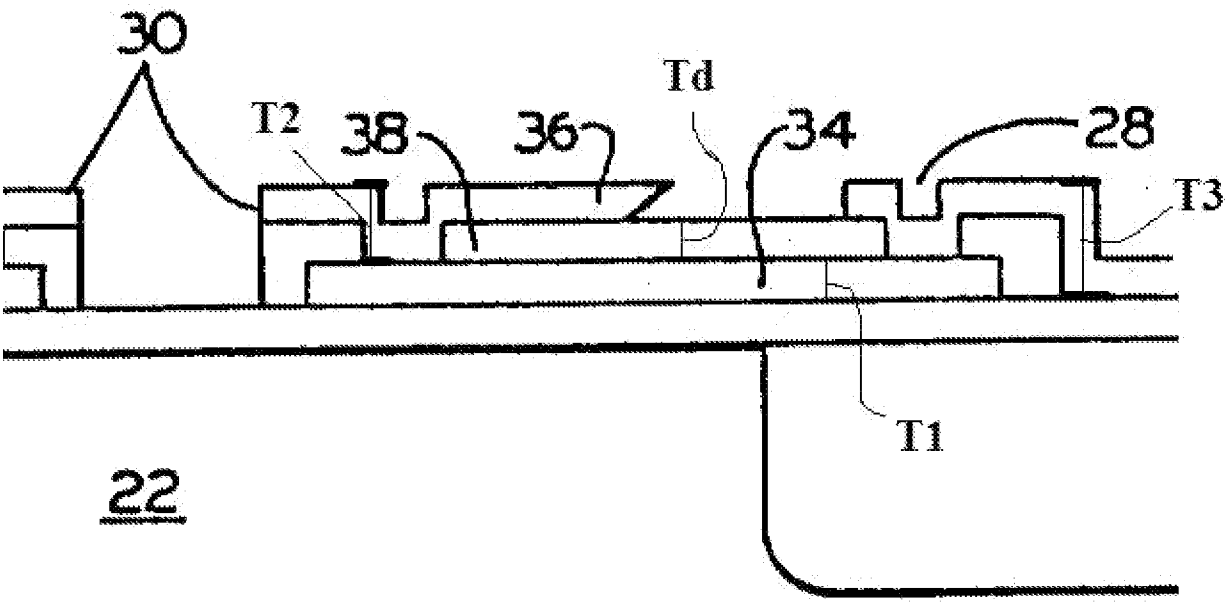

FIG.3.

Blown-up version-1 of FIG. 3 from WISE et al. (U.S. Patent 5,100,479) above includes reference characters T1, T2, T3, and Td added by the examiner along with corresponding lines to indicate a thickness of each layer in a direction normal to the surface.

b. With regards to claim 2, WISE et al. discloses a stacked thermocouple structure wherein the third conductors are formed of the second material (both portions (second &

third conductors) of conductor 36 can be a refractory metal, line 23-26, column 7 "refractory metal").

c. With regards to claim 3, WISE et al. discloses a stacked thermocouple structure wherein the dielectric layer has a thickness in a direction normal to the surface (Td, blown up version-1 of FIG. 3 presented above) that is less than the thickness of the second conductors (Td, or a thickness of the dielectric layer 38 is disclosed in line 11-16, column 7 to be "3000Å thick", T2, or a thickness of the second conductor, which fills hole 52 and traverse over layer 38, thus is at least greater than 3000Å).

d. With regards to claim 5, WISE et al. discloses a stacked thermocouple structure wherein the third conductors and the second ends of the first and second conductors define cold junctions of the stacked thermocouple structure (FIG. 2A & FIG. 3 and see line 28-45, column 5).

e. With regards to claim 7, WISE et al. discloses a stacked thermocouple structure wherein the first and second conductors define steps that are traversed by the third conductors (see FIG. 2B, first conductor 34 thicker than second conductor, portion of 36 above first conductor, which forms steps from the surface to the second conductor of which the third conductor, portion of 36 extending towards next adjacent first conductor, traverses steps from second conductor to surface).

f. With regards to claim 8, WISE et al. discloses a stacked thermocouple structure wherein the surface is defined by a second dielectric layer on a substrate (line 42-46, column 6) and each of the first conductors is on the second dielectric layer (line 60-61, column 6).

g. With regards to claim 9, WISE et al. discloses a thermocouple structure wherein the second conductors have lateral widths less than lateral widths of the first conductors so as to define steps from the substrate to the second conductors, the steps being traversed by the third conductors (see FIG. 2B, first conductor 34 thicker than second conductor, portion of 36 above first conductor, which forms steps from the surface to the second conductor of which the third conductor, portion of 36 extending towards next adjacent first conductor, traverses steps from second conductor to surface).

h. With regards to claim 10, WISE et al. discloses a stacked thermocouple wherein the stacked thermocouple structure is a thermopile (34, FIG. 2A) that is structurally capable of producing an output dependent on a temperature difference between the first and second ends of the first and second conductors (see column 1).

i. With regards to claim 11, WISE et al. discloses a thermocouple structure wherein the thermopile is a component of a thermal sensor package (FIG. 1).

j. With regards to claim 12, WISE et al. discloses a stacked thermocouple structure of a thermopile that produces output dependent on a temperature difference between hot and cold junctions of the thermopile, the stacked thermocouple structure comprising a plurality of first conductors (34, FIG. 3) on a surface (40, FIG. 3) and formed of a first material (line 51, column 5 "polysilicon"), each of the first conductors having first (end closest to aperture 22, FIG. 2A-B and FIG. 3) and second ends (end farthest from aperture 22, FIG. 2A-B and FIG. 3) and a thickness in a direction normal to the surface (T1, blown-up version-1 of FIG. 3 presented below), a dielectric layer on each of the first conductors (38, FIG. 3), a plurality of second conductors (36, FIG. 2B and FIG. 3) on the

dielectric layer (FIG. 3) and formed of a second material that differs from the first material (line 23-26, column 7 "refractory metal"), each of the second conductors having a thickness in a direction normal to the surface (T2, blown-up version-1 of FIG. 3 presented below), a first end (end closest to aperture 22, FIG. 2A-B and FIG. 3) overlying the first end of the corresponding first conductor in a direction normal to the surface and contacting the first end of the corresponding first conductor (via hole 52, FIG. 2A-B and FIG. 3) to define one of the hot junctions of the thermopile (30, FIG. 2A), and a second end (end farthest from aperture 22, FIG. 2A-B and FIG. 3) overlying the second end of the corresponding first conductor in a direction normal to the surface but separated from the second end of the corresponding first conductor by the dielectric layer, and a plurality of third conductors ("L-shaped" portion of 36, FIG. 2B which extends off of each first conductor leading to the next adjacent first conductor), each of the third conductors electrically interconnecting the second end of one of the second conductors with the second end of one of the first conductors to define one of the cold junctions of the thermopile (28, FIG. 2A and FIG. 2B), each of the third conductors having a thickness in a direction normal to the surface (T3, blown-up version-1 of FIG. 3 presented below) that is greater than the thickness of the second conductors (T3, or a thickness of the third conductor portion of 36, traverses over first conductor layer 34 and dielectric layer 38 of which line 2, column 7 discloses T1 to be 8000Å and line 11-16, column 7 discloses Td is 3000Å, thus making T3 at least 11000Å plus some thickness above layer 38, T2 is 3000Å plus some thickness above layer 38, thus T3 is at least thicker than T2 by 8000 Å).

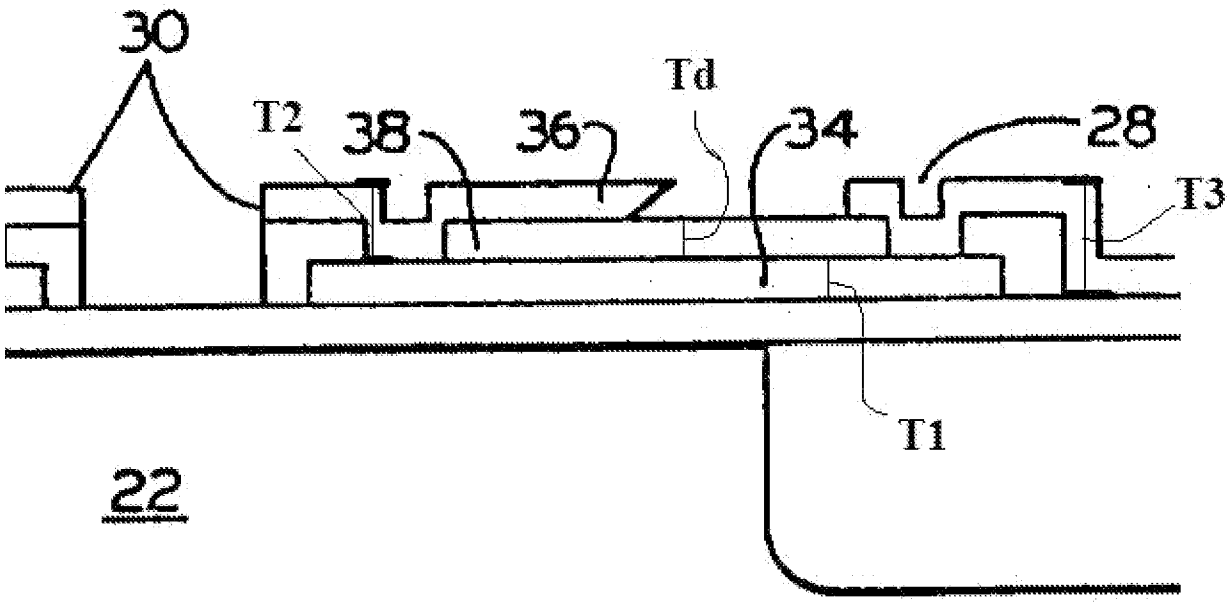

FIG.3.

Blown-up version-1 of FIG. 3 from WISE et al. (U.S. Patent 5,100,479) above includes reference characters T1, T2, T3, and Td added by the examiner along with corresponding lines to indicate a thickness of each layer in a direction normal to the surface.

k. With regards to claim 13, WISE et al. discloses a stacked thermocouple structure wherein the dielectric layer has a thickness in a direction normal to the surface (Td, blown up version-1 of FIG. 3 presented above) that is less than the thickness of the second conductors (Td, or a thickness of the dielectric layer 38 is disclosed in line 11-16,

column 7 to be "3000Å thick", T2, or a thickness of the second conductor, which fills hole 52 and traverse over layer 38, thus is at least greater than 3000Å).

l. With regards to claim 16, WISE et al. discloses a thermocouple structure wherein the thermopile is a component of a thermal sensor package (FIG. 1).

m. With regards to claim 17, WISE et al. discloses a stacked thermocouple structure wherein the first and second conductors define steps that are traversed by the third conductors (see FIG. 2B, first conductor 34 thicker than second conductor, portion of 36 above first conductor, which forms steps from the surface to the second conductor of which the third conductor, portion of 36 extending towards next adjacent first conductor, traverses steps from second conductor to surface).

n. With regards to claim 18, WISE et al. discloses a stacked thermocouple structure wherein the surface is defined by a second dielectric layer on a substrate (line 42-46, column 6) and each of the first conductors is on the second dielectric layer (line 60-61, column 6).

o. With regards to claim 19, WISE et al. discloses a thermocouple structure wherein the second conductors have lateral widths less than lateral widths of the first conductors so as to define steps from the substrate to the second conductors, the steps being traversed by the third conductors (see FIG. 2B, first conductor 34 thicker than second conductor, portion of 36 above first conductor, which forms steps from the surface to the second conductor of which the third conductor, portion of 36 extending towards next adjacent first conductor, traverses steps from second conductor to surface).

5. Claims 1, 4, 12, and 14 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by WISE et al. (U.S. Patent 5,100,479).

a. With regards to claim 1, WISE et al. discloses a stacked thermocouple structure comprising a plurality of first conductors (34, FIG. 3) on a surface (40, FIG. 3) and formed of a first material (line 51, column 5 "polysilicon"), each of the first conductors having first (end closest to aperture 22, FIG. 2A-B and FIG. 3) and second ends (end farthest from aperture 22, FIG. 2A-B and FIG. 3) and a thickness in a direction normal to the surface (T1, blown-up version-2 of FIG. 3 presented below), a dielectric layer on each of the first conductors (38, FIG. 3), a plurality of second conductors (36, FIG. 2B and FIG. 3) on the dielectric layer (FIG. 3) and formed of a second material that differs from the first material (line 23-26, column 7 "refractory metal"), each of the second conductors having a thickness in a direction normal to the surface (T2, blown-up version-2 of FIG. 3 presented below), a first end (end closest to aperture 22, FIG. 2A-B and FIG. 3) overlying the first end of the corresponding first conductor in a direction normal to the surface and contacting the first end of the corresponding first conductor (via hole 52, FIG. 2A-B and FIG. 3), and a second end (end farthest from aperture 22, FIG. 2A-B and FIG. 3) overlying the second end of the corresponding first conductor in a direction normal to the surface but separated from the second end of the corresponding first conductor by the dielectric layer, and a plurality of third conductors ("L-shaped" portion of 36, FIG. 2B which extends off of each first conductor leading to the next adjacent first conductor), each of the third conductors electrically interconnecting the second end of one of the second conductors with the second end of one of the first conductors other than

the first conductor on which the second conductor lies (FIG. 2B), each of the third conductors having a thickness in a direction normal to the surface (T3, blown-up version-2 of FIG. 3 presented below) that is greater than the thickness of the second conductors (T3, or a thickness of the third conductor portion of 36, traverses over first conductor layer 34 and dielectric layer 38 of which line 2, column 7 discloses T1 to be 8000Å and line 11-16, column 7 discloses Td is 3000Å, thus making T3 at least 11000Å plus some thickness above layer 38, T2 which fills hole 52 is depicted to be the thickness of the dielectric layer which is 3000Å, thus T3 is at least thicker than T2 by 8000 Å).

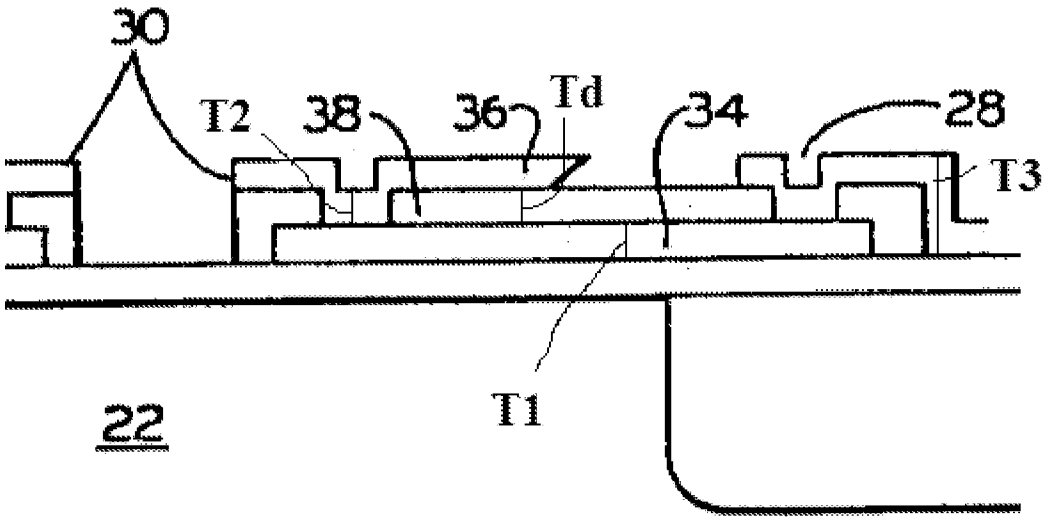

FIG.3.

Blown-up version-2 of FIG. 3 from WISE et al. (U.S. Patent 5,100,479) above includes reference characters T1, T2, T3, and Td added by the examiner along with corresponding lines to indicate a thickness of each layer in a direction normal to the surface.

b. With regards to claim 4, WISE et al. discloses a stacked thermocouple structure wherein the thickness of the third conductors are more than three times greater than the thickness of the second conductors (T3, or a thickness of the third conductor portion of 36, traverses over first conductor layer 34 and dielectric layer 38 of which line 2, column 7 discloses T1 to be 8000Å and line 11-16, column 7 discloses Td is 3000 Å, thus making T3 at least 11000 Å plus some thickness above layer 38, T2 which fills hole 52 is depicted to be the thickness of the dielectric layer which is 3000Å, thus making T3 at least three times greater than T2).

c. With regards to claim 12, WISE et al. discloses a stacked thermocouple structure of a thermopile that produces output dependent on a temperature difference between hot and cold junctions of the thermopile, the stacked thermocouple structure comprising a plurality of first conductors (34, FIG. 3) on a surface (40, FIG. 3) and formed of a first material (line 51, column 5 "polysilicon"), each of the first conductors having first (end closest to aperture 22, FIG. 2A-B and FIG. 3) and second ends (end farthest from aperture 22, FIG. 2A-B and FIG. 3) and a thickness in a direction normal to the surface (T1, blown-up version-2 of FIG. 3 presented below), a dielectric layer on each of the first conductors (38, FIG. 3), a plurality of second conductors (36, FIG. 2B and FIG. 3) on the dielectric layer (FIG. 3) and formed of a second material that differs from the first material (line 23-26, column 7 "refractory metal"), each of the second conductors having a thickness in a direction normal to the surface (T2, blown-up version-2 of FIG. 3 presented below), a first end (end closest to aperture 22, FIG. 2A-B and FIG. 3) overlying the first end of the corresponding first conductor in a direction normal to the surface and

contacting the first end of the corresponding first conductor (via hole 52, FIG. 2A-B and FIG. 3) to define one of the hot junctions of the thermopile (30, FIG. 2A), and a second end (end farthest from aperture 22, FIG. 2A-B and FIG. 3) overlying the second end of the corresponding first conductor in a direction normal to the surface but separated from the second end of the corresponding first conductor by the dielectric layer, and a plurality of third conductors ("L-shaped" portion of 36, FIG. 2B which extends off of each first conductor leading to the next adjacent first conductor), each of the third conductors electrically interconnecting the second end of one of the second conductors with the second end of one of the first conductors to define one of the cold junctions of the thermopile (28, FIG. 2A and FIG. 2B), each of the third conductors having a thickness in a direction normal to the surface (T3, blown-up version-2 of FIG. 3 presented below) that is greater than the thickness of the second conductors (T3, or a thickness of the third conductor portion of 36, traverses over first conductor layer 34 and dielectric layer 38 of which line 2, column 7 discloses T1 to be 8000Å and line 11-16, column 7 discloses Td is 3000Å, thus making T3 at least 11000Å plus some thickness above layer 38, T2 which fills hole 52 is depicted to be the thickness of the dielectric layer which is 3000Å, thus T3 is at least thicker than T2 by 8000 Å).

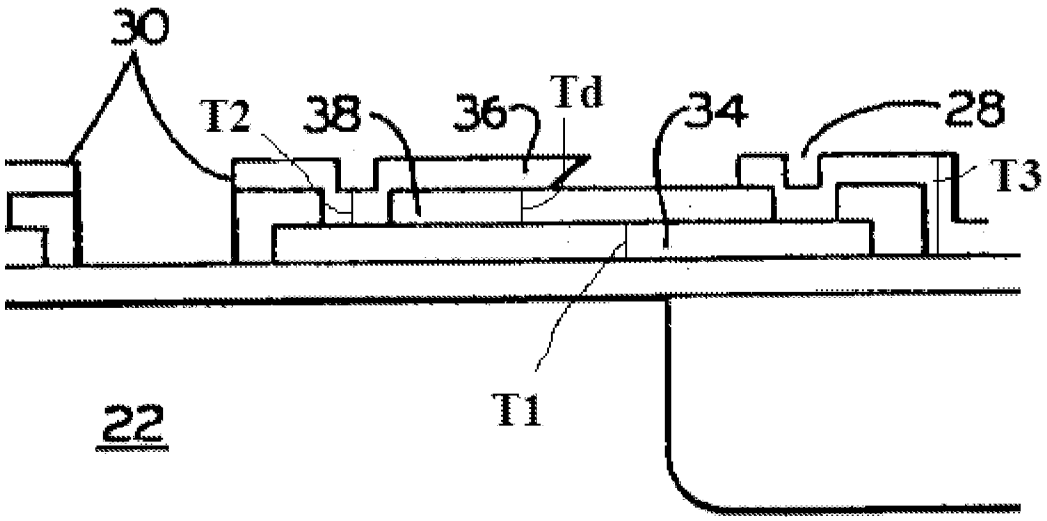

FIG.3.

Blown-up version-2 of FIG. 3 from WISE et al. (U.S. Patent 5,100,479) above includes reference characters T1, T2, T3, and Td added by the examiner along with corresponding lines to indicate a thickness of each layer in a direction normal to the surface.

d. With regards to claim 14, WISE et al. discloses a stacked thermocouple structure wherein the thickness of the third conductors are more than three times greater than the thickness of the second conductors (T3, or a thickness of the third conductor portion of 36, traverses over first conductor layer 34 and dielectric layer 38 of which line 2, column 7 discloses T1 to be 8000Å and line 11-16, column 7 discloses Td is 3000 Å, thus making T3 at least 11000 Å plus some thickness above layer 38, T2 which fills hole 52 is depicted to be the thickness of the dielectric layer which is 3000Å, thus making T3 at least three times greater than T2).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 6 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over WISE et al. (U.S. Patent 5,100,479) in view of HAMAMOTO et al. (U.S. PG-Pub 2002/0185169 A1).

a. Independent claims 1 and 12 are clearly anticipated by WISE et al. under 35 U.S.C. 102(b) as discussed above. WISE et al. discloses a stacked thermocouple structure wherein the first conductor material is polysilicon (line 51, column 5 "polysilicon"). WISE et al. discloses the second conductor material is preferably a refractory metal that has a lower thermal conductivity than gold and suggest tantalum.

WISE et al. does not appear to explicitly disclose a stacked thermocouple device wherein the second conductor material is specifically aluminum.

However, as made evident by HAMAMOTO et al., it is conventional to use a polysilicon/aluminum thermocouple in a thermopile type infrared sensor (**[0041]**). Furthermore, aluminum is generally cheaper than tantalum and also offers a thermal conductance lower than gold. The only difference between the claimed invention and the device of WISE et al. is the material of the second conductor.

Thus, at the time of the invention, it would have been obvious to a person having ordinary skill in the art to modify the second conductor material of WISE et al. to include using aluminum as the second conductor, as disclosed by HAMAMOTO et al., because aluminum is generally cheaper than tantalum and because aluminum would still offer a lower thermal conductance compared to gold.

Response to Arguments

9. Applicant's arguments with respect to claims 1-19 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DUSTIN Q. DAM whose telephone number is (571)270-5120. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571)272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kaj K Olsen/
Primary Examiner, Art Unit 1795

dd
December 17, 2008